J. Jeffries.

(3)

AN
ESSAY
ON THE
FRACTURE
OF THE
PATELLA OR KNEEPAN.

CONTAINING

A new and efficacious Method of treating that Accident, by
which the Deformity and Lameneſs that ariſe from the
old and common Mode of Treatment, are avoided.

WITH OBSERVATIONS ON THE

FRACTURE OF THE OLECRANON,

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MDCCLXXXIX.

ON THE

FRACTURE OF THE PATELLA.

AS the methods of cure, which are made uſe of by Surgeons in fractures of the *Patella*, have long appeared to me defective;—as a great number of prejudices have continually ariſen in practice, from this ſubject not being rightly underſtood, and ſince thoſe who have had the misfortune to incur this accident and have been treated in the uſual mode, ſuffer ſuch a degree of lameneſs as to occaſion a very conſiderable inconvenience in progreſſion, and are likewiſe rendered more liable not only to refracture the ſame *Patella*, but alſo to fracture this bone in the oppoſite limb, by which means their lameneſs is doubled, and they hence become diſpoſed more than before to falls and fractures of the *Patella*, as will clearly be proved in the ſequel of theſe obſervations. I have, for theſe reaſons, for a long time ſince paid a very particular attention to this diſeaſe, and to the anatomy of the parts concerned in the fracture; and having diſcovered the cauſe of this defect in practice, am now able to propoſe a method of cure by which all thoſe obſtacles which ariſe from the uſual mode of conducting it, and which remain during the Life of the patient, will be altogether prevented, and the motion of the limb rendered equally extenſive as it had been previous to the accident. I have been the rather invited to the ſtudy of this ſubject from having been unfortunate (I had almoſt ſaid fortunate) enough to have fractured the *Proceſſus Olecranon* in my left arm, about ten or twelve years ſince; a fracture in many circumſtances analogous, in its ſituation and anatomy, to the fracture of the *Patella*. I therefore hope, as the ſubject of this eſſay is not only new, but very important to all practitioners of the art of ſurgery, as well as to mankind in general, ſince it endeavours not merely to clear away old and abſurd prejudices, but to eſtabliſh a new and certain mode of cure, which has its foundation firmly laid in the ſtrong and ſolid baſis of anatomy and experience, that it will meet with a favourable reception.

To underſtand rightly what I have to offer on the ſubject, it will be neceſſary to deſcribe ſo much of the anatomy of the knee-joint and muſcles of the lower extremity as are concerned in this fracture. The *Patella*, *Rotula*, or Knee-pan, ſerves for the inſertion of the extenſor muſcles of the leg, and is analogous to the *Proceſſus Olecranon*, *ſeu Ancon* of the bone *Ulna* in the fore arm. In ſome animals, as in the birds of the ſpecies *Diomedea Linnæi* (Penguin) the *Patella* is nothing more than a proceſs of bone continued upwards from the *Tibia* ; the internal or articular ſurface enters into the compoſition of the knee-joint, it is connected to the *Os femoris* and *Tibia* by the capſular ligament, and to the tuberoſity of the *Tibia* by a ſtrong ligament which is fixed to its lower part, or *Apex* ; the upper part, or *Baſis* of the *Patella* receives the large common tendon of the extenſor muſcles of the leg ; the *Patella* is ſometimes ſituated in the anterior portion of the ſinuoſity, which is found between the condyles of the *Os Femoris* ; in the extenſion of the leg it riſes with the extenſor muſcles and tendon; in the flexion it deſcends with the leg; the muſcles, which are inſerted by the intervention of this tendon, are called the extenſor muſcles of the leg, and are the *Vaſtus externus & internus*, *Cruræus & Rectus Cruris*; the *Vaſtus externus* is ſituated on the outſide of the *Os Femoris*, ariſes from the poſterior, or convex rough ſurface of the great *Trochanter*, from about two-thirds of the ſuperior portion and outſide of the *Linea aſpera* of the *Os Femoris*, and, from a part of the *Faſcia lata*, it is inſerted into the neareſt edge of the common tendon, into the ſide of the *Patella*, into the edge of the ligament of that bone, and into the neighbouring lateral part of the head of the *Tibia*; its loweſt fibres run in a little behind the *Rectus*, where they are inſerted. The *Vaſtus internus* is ſituated on the inſide of the thigh bone, ariſes above by a ſhort flat tendon from the anterior ſurface of the great *Trochanter*; from the anterior portion of the root of the neck of the thigh bone, and from the inſide of the *Os Femoris* & *Linea aſpera*; it is inſerted into the ſide of the common extenſor tendon, which is neareſt to it, into the edge of the *Patella*, and on the ſide of the ſuperior extremity of the *Tibia*. The *Cruræus* ariſes from all the anterior ſurface of the *Os Femoris*, which is ſituated between the two *Vaſti*, is united laterally with thoſe two muſcles, and is inſerted into the common tendon under the *Rectus Cruris.* The *Rectus Cruris, ſeu Femoris* (ſo called becauſe it runs ſtraight down the thigh) has a double origin; it is a complete penniform muſcle, it ariſes by a very ſtrong tendon, which divides into two branches, one ſhort and ſtraight, the other long and bent; the ſhorteſt ariſes from the anterior inferior ſpinal proceſs of the *Ilium*; the long branch ariſes from the *Ilium*, is inflected backwards over the *Supercilium* of the *Acetabulum* and runs in the direction of the *Supercilium*; it is ſtrong and flat, adheres very cloſely to the bone, and is covered by the capſular ligament and the *Glutæus minimus:* from thence the muſcle runs down wholly fleſhy, and partly penniform, ſome of its fibres meeting above and ſeparating below; it is narrow at the upper extremity, and grows gradually broader towards the middle, afterwards it contracts again in the ſame manner, and at the lower extremity of the *Os Femoris* ends in a broad flat tendon; through its whole courſe it lies between the two *Vaſti*, and covers the *Cruræus*; —its inferior tendon is inſerted in the upper edge of the *Patella*, from whence it ſends down a ſmall plane of tendinous fibres, which adheres very cloſely to the convex ſide of that bone, and, having reached the great ligament, ſeems to be loſt therein. Theſe muſcles extend the leg by pulling up the *Patella*, which plays in the groove between the two condyles of the *Os Femoris*, as a rope in a pully, and therefore theſe muſcles (particularly the *Rectus Cruris*) act with great mechanical advantage; they not only extend the leg, but aſſiſt, likewiſe, in keeping the thigh-bone fixed upon the *Tibia* in the erect poſture; in balancing the body; and in ſtraightening the knee-joint, when the legs become fixed points. The *Rectus Cruris*, as it paſſes over the anterior ſurface of the hip-joint, is capable of acting upon the trunk, and ſhould be conſidered as a flexor muſcle of the trunk, as well as an extenſor of the leg: indeed the whole of the extenſor muſcles of the leg are capable of bending the trunk;

the *Vaſti* and *Cruræus* being connected with the common extenſor tendon, and this tendon with the *Rectus*, it follows, that the contraction of the fibres of the *Vaſti* and *Cruræus*, which are connected with the extenſor tendon, will co-operate with the *Rectus* in producing the flexion of the trunk when the knee-joint is fixed; from the great length of the *Rectus Cruris*, but more eſpecially from its complete penniform ſtructure, it is capable of producing a much greater degree of accurtation than the other extenſor muſcles, and is inſerted to a greater mechanical advantage, by being fixed to the *Patella* in a ſtraight line with the *Baſis*: we may obſerve at preſent, that the *Vaſtus externus*, *in-*

ternus & *Cruræus*, with their common tendon, paſs over the knee-joint alone, whilſt the *Rectus Cruris* paſſes over the hip-joint, as well as that of the knee; the *Vaſtus Externus* & *Internus* are to be conſidered as half penniform, the *Crurræus* and *Rectus Cruris* as complete penniform muſcles; we may likewiſe obſerve, that theſe muſcles and the flexors of the leg, which lie upon the thigh, and indeed the other muſcles which are ſituated thereon, and called muſcles of the thigh, are all put upon the ſtretch, when the trunk, thigh and leg form a right line, and, on the contrary, are relaxed, when the hip and knee-joint are bent.

I ſhall next endeavor to explain the manner in which the *Patella* is generally fractured: other bones are moſt commonly fractured by external violence, the *Patella* in general from internal cauſe, or, at leaſt, very differently from other bones. A perſon, for example, is about to fall backward, the trunk of the body at this time is acting with a great length of lever on the inferior extremity, the ſubject endeavors to ſuſtain the falling weight by all thoſe muſcles which paſs from the leg and thigh into the anterior portion of the *Pelvis*, and particularly by the action of the *Rectus Cruris*, which is a moſt powerful muſcle, and, as we have before obſerved, capable of producing great contraction; the other extenſors of the leg are likewiſe in action at the ſame time upon their common tendon, and as they aſſiſt the *Rectus* in the extenſion of the leg, it is moſt probable they act with that muſcle at this time ; the *Patella* is placed exactly between the condyles of the *Os Femoris*, and is now in contact by little more than a line—the weight of the body falling—the ſtrong action of the muſcles, which is produced in jerks—the leg fixed—the knee bent—the *Patella* circumſtanced as I have juſt now mentioned—all theſe things conſpire to produce the tranſverſe fracture of this bone. At leaſt one of the following occurrences muſt take place : either the body falls—or it is ſuſtained—or the

Patella is fractured—or the ligament between the *Patella* and *Tibia*—or the common extenſor tendon, which is inſerted in the *Baſis* of the *Patella*, is lacerated; both of theſe latter accidents I have likewiſe ſeen.

Many of thoſe who have had the misfortune to fracture the *Patella*, have mentioned, that they heard the ſnapping noiſe occaſioned by its diviſion before they fell to the ground.

We have now a tranſverſe fracture of this bone without contuſion and extending into the cavity of the joint.

I ſhall next proceed to the *Diagnoſis* of this fracture.

In a recent tranſverſe fracture of the *Patella*, it is certainly not difficult to diſtinguiſh the nature of the accident—as the bone is ſituated ſo ſuperficially, that the interſtice between its divided portions is eaſily diſcovered by the eye as well as by the application of the hands. The ſuperior portion of the fractured bone will be carried upwards towards the thigh, by the extenſor muſcles, whilſt the inferior portion will remain in contact with the ligament which connects it with the *Tibia*.

Great caution is neceſſary, on the part of the ſurgeon, in examining fractures of the *Patella*, particularly with reſpect to bending the knee-joint; if any portion of the tendons of the muſcles remain, as thoſe of the *Vaſtus Externus & Internus*, they are liable to be lacerated by the flexion of the leg, and we have a moſt remarkable inſtance, in M. Petit, of this kind*; where an ignorant bone-ſetter, in a caſe of fractured *Patella*, produced the inſtant death of the patient, by roughly bending the knee-joint.

We are now to conſider what is done by ſurgeons to effect a cure.

The firſt principle to be purſued in fractures, is to coaptate the bones, and to retain them in approximation; this they endeavour to produce by extending the leg, by which means they imagine the extenſor muſcles are relaxed, and this is certainly the caſe when the *Patella* is not fractured, and I have great reaſon to believe, that moſt of the opinions that have been entertained upon this ſubject, have been drawn from the phyſiology of the parts in a natural ſtate, without conſidering that the connection between the muſcles and inferior portion of the *Patella* is moſt generally annihilated when this bone is fractured. They extend the leg, on a ſuppoſition of relaxing the *Vaſtus Externus* & *Internus*, *Cruræus* & *Rectus Cruris* to the greateſt degree: the leg, thigh and trunk of the body are placed in the ſame right line, by which poſition the muſcles are not at all relaxed; the ſuperior fractured portion of the bone is drawn up towards the thigh, and removed to a conſiderable diſtance from the inferior portion; this ſeparation of the divided portions of the fractured *Patella*, depends upon the *Rectus Cruris* being drawn up by its attachments to the *Pelvis*, the anterior portion of which, whence this muſcle riſes, being at a greater diſtance from the knee, in the extended poſition of the trunk and thigh, than when theſe parts are bent; from the connection of the *Vaſti* & *Cruræus* with the *Rectus Cruris*, they are drawn towards the *Pelvis* with the common Tendon and the ſuperior fractured portion of the *Patella*; inſtead therefore of producing the approximation and coaptation of the fractured portions of bone, which they intended by this poſition, they have cauſed a greater ſeparation of the parts; and from this poſition being continued, the elongation of the *Patella*, and lameneſs that takes place after the cure, moſt certainly ariſe. The Surgeon ſhould be exceedingly cautious not to bend the knee-joint, as it may occaſion a laceration of thoſe lateral portions of the tendons of the *Vaſtus externus* and *internus* muſcles, which paſs downwards, to be expanded in the *faſcia* of the leg, and which are likewiſe connected with the *Tibia* and *Fibula*; the capſular ligament of the knee, already partially divided, may likewiſe be more lacerated by ſuch incautious flexion of the leg. The patient ſhould be inſtructed not to bend the leg; and therefore ſuch contrivances ſhould be uſed as will prevent him from effecting flexion during ſleep. The extenſion of the leg will bring up the inferior fractured portion of *Patella* with its ligament, and will approximate and relax the lacerated parts of the capſular ligament; it will relax alſo, all ſuch fibres of the *Vaſti* as are inſerted in thoſe lateral portions of tendon which are not torn; but the *Rectus Cruris*, *Cruræus* and major part of the *Vaſti*, which paſs into the ſtrong common tendon which is inſerted in the upper part or *baſis* of the *Patella*, will not be relaxed at all by extending the leg, as the *Patella* is now divided tranſverſely; and it is a very remarkable circumſtance in the hiſtory of Surgery, that all the writers upon this ſubject, ſuppoſe that the extenſor muſcles in the fracture of the *Patella*, are relaxed to the utmoſt by extending the leg, and thoſe anatomiſts, whoſe opinions I am acquainted with, as the late Dr. Hunter, Mr. J. Hunter, the late and preſent Profeſſor Monro, and every other teacher or writer I have ſeen or heard of, have entertained the ſame opinion, though the contrary is evidently the caſe: this is one of the very many things in anatomy, as well as in other ſciences, which has been taken for granted. I believe then, I may venture to aſſert, that the extenſion of the leg is only capable of bringing up the inferior portion of the *Patella*, relaxing the torn capſular ligament, and ſuch fibres of the *Vaſti* as are inſerted in thoſe portions of the tendon which are not divided.

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* See Petit Maladies des Os, Vol. 2. p. 232.

Let us next conſider what further is attempted to effect a cure.

The patient is put to bed, laid on his back, his leg extended, in a word, his trunk, thigh and leg compoſe a right line; they proceed upon the principle of relaxing the extenſor muſcles and bringing the divided portions of bone into contact; and their principle is juſt, but the means adopted are inadequate; they overlook the origin of the *Rectus Cruris*, and full uſe of the other extenſors; they do not conceive that it is of more conſequence, in this caſe, to conſider the poſition of the thigh and trunk than that of the leg. The fact is, that by placing the trunk and thigh in a right line, thoſe parts of the *Ilium*, to which the *Rectus* is attached, are removed to a greater diſtance from the *Patella*; the *Rectus Cruris* is drawn upwards, and the *Vaſti* and *Cruræus*, which are connected with the common tendon, and now wholly ſeparated from the inferior portion of *Patella*, are drawn up likewiſe by the *Rectus Cruris* being pulled up, and the ſuperior fractured portion of *Patella* is removed to a very conſiderable diſtance from the inferior fractured portion; they next endeavor to keep down the ſuperior and to bring up the inferior portion of *Patella* by bandage, and the continual ſtretching of the muſcular fibres of the *Rectus Cruris*, in this caſe, excites a ſpecies of involuntary action in the muſcle, by which it endeavors continually, except perhaps during ſleep, to bring up the ſuperior portion of *Patella*, and, of courſe, to produce a ſeparation between the fractured portions; in ſhort, if the patient is put in this poſition, the Surgeon will find himſelf incapable of retaining the fractured portions in approximation, with all his art, and all the apparatus his ingenuity may contrive.

In conſequence of the fractured portions being removed to a conſiderable diſtance from each other, there is no union by *Callus*, but by ligamentous fibres, a circumſtance that does not ariſe in any other ſpecies of fracture; and indeed it is a very fortunate occurrence for the patient that it is not united by *Callus* in this inſtance, as the elongated bony *Patella* would be more ſubject to fracture than before the accident. The reaſon the fractured portions are not united by *Callus*, is, I think, eaſily explained, if we conſider that the *Patella* is a very ſmall ſpongy bone, and weak in oſſific powers; we cannot ſuppoſe, even *a priori*, that a bone of ſuch dimenſions ſhould be capable of producing a *Callus* longer, in many caſes, than the bone itſelf.

This fracture is ſometimes attended with a conſiderable degree of inflammation; in others, little or no inflammation takes place; when it does, conſiderable pain will ariſe from the inflammation ſpreading to and over, perhaps, the whole of the internal ſurface of the capſular ligament of the knee-joint, and it is poſſible (though I have never heard of a caſe of that kind) that ſuppuration may take place in the cavity of the joint, it may therefore be neceſſary, in many caſes, to moderate the inflammation, though, in general, it ſeldom obtains to a great degree.

Let us next conſider the defects or ill conſequences that ariſe from the elongation of the *Patella*. In a ſound limb, the natural degree of contraction of the extenſor muſcles is capable of producing the complete extenſion of the leg, and of acting upon the thigh and trunk, as has been obſerved in a former part of this eſſay. From the *Patella* being lengthened, the extenſor muſcles are not capable of producing the complete extenſion of the leg, and other defects muſt ariſe in ſuſtaining the trunk, ſtraightening the knee-joint, and other motions of the trunk and lower extremity; hence it muſt follow that the inconvenience will be augmented in proportion to the diſtance between the fractured portions of the bone, as a greater degree of contraction will be required in the extenſor muſcles of the leg, to compenſate for the elongation of the *Patella*. The patient from not being able to ſtraighten the knee-joint, will find a great inability in endeavoring to aſcend upon inclined planes, particularly in going up a hill or ſtair-caſe, for the following reaſons. In paſſing an aſcent, the knee and hip-joint are bent to raiſe the foot on the hill or ſtair, the knee-joint is next ſtraightened by the aſſiſtance of the extenſor muſcles, and this bending and extending of theſe joints is performed alternately in walking up ſtairs or aſcending hills; it will be found, that thoſe who have fractured the *Patella*, and are treated in the common way, in making ſuch attempts will be liable to fall backward and incur the riſk of breaking the other *Patella*; and in many of thoſe who have fractured both, I have known them obliged to be carried up and down ſtairs, from their being totally unable to effect it alone; for they will find ſome inconvenience in deſcending, though not near ſo much as in aſcending. In general, the cauſe of the defect I have juſt noticed, has not been rightly underſtood; ſome have thought that the joint has been ſtiff in conſequence of the *Callus* ſhooting or falling into to the cavity of the capſular ligament, or from the capſular ligament being thickened in conſequence of inflammation attending the fracture; in ſhort, many cauſes have been ſuſpected, and I know of no one who has had any juſt idea of the real nature of this defect, but Mr. John Hunter; he has obſerved, that the contraction of the muſcles after the *Patella* is elongated, was not capable of effecting the complete extenſion of the leg; and he has propoſed to remedy it by a very ingenious method; he adviſes that the patient ſhould, as often as poſſible, endeavor to extend the leg to its utmoſt limits, and he conceives that the muſcles will, by ſuch efforts, be rendered capable of producing a greater degree of accurtation. He likewiſe adviſes, that the patients be placed in a high chair or ſeated upon a table, that weights be buckled on the foot near the toes, and that they endeavor to extend the leg as much as poſſible; the weights are to be augmented by ſlow degrees. He is of opinion, that by a conſtant practice of this kind, not only the ſtrength of the extenſors will be increaſed, but the degree of contraction alſo; and it may be poſſible that a ſmall elongation of the *Patella* may be conſiderably relieved, or even cured by this method; but ſuch elongations as are moſt generally found to ariſe from the common mode of treatment, will certainly not be cured by theſe means.

This very ingenious contrivance of Mr. Hunter's, ſhews us clearly where the defect lies; it depends upon the elongation of the *Patella*; and therefore teaches us to uſe every means in our power to prevent it. It is poſſible that patients, who have fractured the *Patella*, may receive benefit by any contrivance that will bring the divided portions of the bone nearer to each other.

When I came to reflect attentively upon this fracture, the natural actions and co-operations of the muſcles of the lower extremity; I ſoon diſcovered that the elongation of the *Patella* depended upon the *Rectus Cruris* not being ſufficiently relaxed during the cure; it is ſuppoſed by anatomiſts and ſurgeons, that the extenſor muſcles are much relaxed in the caſe of fracture of the *Patella*, by extending the leg; but I have demonſtrated clearly in a former part of this eſſay, that this is very far from being the caſe. The only way to relax the *Rectus Cruris* as well as the other extenſors is, to bend the hip-joint, for the muſcles are ſtill connected to the *Ilium* at its origin; by this means, not only the whole of the extenſor maſs will be brought downwards and thus approach the knee-joint, but the ſuperior fractured portion of *Patella* will be approximated with the inferior portion, the *Muſculi Vaſti* & *Cruræus* will be relaxed alſo and depreſſed; in the former, or old mode of treatment, all theſe muſcles are drawn upwards by placing the trunk and thigh in the ſame right line, by this method the whole of the ſituation of the muſcles, in this reſpect, is reverſed, they are all looſe and relaxed, and now it will be found that the fractured portions of bone can be eaſily brought in contact with each other without violence, and as eaſily retained in accurate approximation by aſſiſtance of the bandage hereafter to be deſcribed. To place this matter in a clear point of view, I ſhall mention an experiment or two which I have made, and which any perſon may repeat with very little trouble, on the living body or artificial ſkeleton. In a ſkeleton meaſuring ſix feet one inch in height, I found the diſtance between the anterior inferior ſpinous proceſs of the *Ilium*, and baſis of the *Patella*, when the trunk and limb were in the ſame right line, to be twenty inches and an half; the diſtance between theſe two points, when the hip-joint was ſo much bent that the thigh and leg formed a right angle with the trunk of the ſkeleton, was equal to eighteen inches; it is therefore evident that two inches and one half would have been gained in this ſubject in a fracture of the *Patella*, by bending the hip-joint ſo much as to produce a right angle with the trunk; but I ſhall ſhew preſently, that a greater reduction of the ſpace between theſe two points can be effected, ſhould it ever be found neceſſary.

In a fractured *Patella* which I have in my poſſeſſion, the diſtance between the divided ſurfaces is equal to one inch, one half and one eighth; which elongation would certainly have been compenſated for, by that poſition of the trunk and limb which I have juſt now propoſed. The patient to whom this *Patella* belonged, ſuffered two fractures, at different periods of time, in the ſame knee; the firſt time I did not attend her; during the ſecond fracture I was called in, and ſhe was treated both times in the old way, for I had not at that time diſcovered this method of treating that embarraſſing accident.

The greater number of fractured *Patellæ* I have ſeen after the cure in the old way, have had the ſeparated portions, diſtant from each other, from three to four inches, and I have ſeen ſome at a diſtance of four inches and an half; ſpecimens of this kind will be found in the plates annexed to this work; if the fractured portions of the *Patella* are accurately united, they will be joined by oſſific matter; an inſtance of this kind is ſeen in plate 2. fig. 3. where it is deſcribed with ſome others which Profeſſor Camper of Holland was ſo obliging as to draw for me when in London in the year 1785.

In this mode of treatment, thoſe inconveniences I have before mentioned cannot poſſibly ariſe, as the *Patella* is not thereby elongated. There is a circumſtance of ſome conſequence which I have lately obſerved, with reſpect to the poſition of the limb, and on that account cannot omit noticing it. If the leg be extended ſo much as to form a right line with the thigh, and the hip-joint be much bent, all thoſe flexors of the leg which ariſe from the tuberoſity of the *Iſchium*, and which are inſerted into the lateral ſurfaces of the ſuperior extremities of the *Tibia* and *Fibula*, will be conſiderably ſtretched, and render the poſture very inconvenient and painful to the patient ; I have likewiſe remarked, if the leg and thigh are ſo ſituated, and the former is ſupported by the calf being placed upon an horizontal plane (a chair for example) that when the perſon endeavors to bend the trunk upon the thigh bone, pain and a ſpecies of involuntary action is excited in the bellies of the *Gaſtrocnemii* muſcles, they grow hard and tenſe, and a ſenſation like the firſt approach of a fit of the cramp ariſes, which is almoſt intolerable. This inconvenience, which may appear at firſt ſight mechanically impoſſible to be remedied, without putting the extenſor muſcles upon the ſtretch, is in reality eaſy to effect, and if it be neceſſary to produce a greater degree of relaxation in the extenſor muſcles, or to ſpeak more correctly, if it be ever neceſſary to depreſs the ſuperior portion of *Patella*, it can be executed with great eaſe by bending the knee a little; it will be found that the flexor muſcles of the leg are inſerted at a greater diſtance from the centre of motion of the knee-joint, than the extenſors of the leg; therefore the flexor muſcles will be conſiderably relaxed by bending the knee a little, and this flexion will occaſion no inconvenience in reſpect to the ſtretching of the extenſors, ſince theſe muſcles are inſerted nearer to the centre of motion of the joint; for the baſis of the *Patella*, where theſe extenſors are inſerted, will be raiſed to a very little diſtance from the centre of motion; this ſtretching of the flexor muſcles, not only depends upon the *Tibia* being extended, but likewiſe upon the tuberoſity of the *Iſchium* being further removed from the thigh-bone, and, of courſe, the ſpace between the tuberoſity of the *Iſchium* and thoſe parts of the *Tibia* and *Fibula*, where theſe muſcles are inſerted, is increaſed in length, from the bending the thigh or trunk of the body, and the flexor muſcles, in conſequence, are ſtretched, and a painful ſenſation is excited if the limb is placed in this poſition; in order to convince my reader of this fact, I would wiſh him to place himſelf in a ſetting a ſetting poſture in a chair, and to lay his leg, with the calf downward, upon a ſtool or chair of the ſame height as that upon which he is ſetting, then let him bend his trunk and he will find a very diſagreeable ſenſation excited not only in the flexor muſcles of the leg, but alſo in the extenſor muſcles of the *Tarſus*, ſomewhat ſimilar to the cramp ; it is therefore proved by the foregoing obſervations, that a ſmall degree of flexion in the knee-joint is abſolutely neceſſary, and this will not produce the leaſt inconvenience in regard to ſeparating the fractured portions of the *Patella* ; the divided ſurfaces may now be brought into accurate contact and eaſily retained by bandage.

I ſhall next explain fully the new mode of treatment which has been made uſe of, and from the adoption of which, the motions of the limb are rendered as extenſive as before the accident. In a recent caſe of fractured *Patella*, if much ſwelling and tenſion ſhould come on, I would not put on any bandage for fear of increaſing the tumefaction; I would lay the patient in bed on either ſide, according to his own cuſtom, or convenience, with the hip-joint bent and the knee a little bent alſo, as before directed. To aſcertain the degree of flexion of the hip-joint, let it be equal to bringing down the ſuperior portion of the fractured *Patella* to unite with the inferior portion; the patient, in this mode of treatment, lies in an eaſy, relaxed and natural poſition, which he can change from ſide to ſide—in the old way, he lies in a very diſagreeable and unpleaſant ſituation, being obliged to reſt on his back during the time he is confined to his bed. If there is no tenſion or ſwelling, the common compound linen bandage, deſcribed by Heiſter, may be made uſe of, but the one made of leather, deſcribed by Mr. Bromfield, and which is prepared by the ſurgeon's inſtrument makers in London, will anſwer better; or I would make uſe of a hint which I found in a treatiſe on the fracture of the *Patella*, by *Meimbomius*, which is among the *Diſſertationes Chirurgicæ* of Haller; he ſays a ſhepherd fractured his *Patella*, and plaited ſtraw around it, ſo as to keep the fractured portions in union; we are not told by *Meimbomius*, but we muſt ſuppoſe, as the ſhepherd did it himſelf, that he moſt probably ſat with his knee in the ham of the affected Limb, to bring it near his eyes and hands, in order to plait the ſtraw; he would no doubt therefore keep the relaxed poſition which I have recommended; in ſhort, he got a perfect cure: ſtraw therefore might be plaited round the *Patella* by an ingenious baſket maker, and to keep on the cap, or circle round the *Patella*, circulars of ſtraw connected with the cap, might be plaited around the leg and thigh: a better bandage cannot perhaps be invented than this. To prevent the patient from extending the thigh or bending the knee more than is neceſſary during ſleep, ſome kind of bandage ſhould be made uſe of; this is ſo ſimple and eaſy to effect, that it is unneceſſary for me to deſcribe it. I would adviſe the patient to wear the bandage on the knee for ſome time after the union of the fractured bone. Nothing then can be more ſimple than this method of treatment, and its advantage over the old mode muſt be obvious to every candid perſon who is acquainted with anatomy, and who will read this eſſay with attention.

This mode of treatment has been carried into practice, and has been found to be equal to producing a perfect union of the fractured portions of the *Patella*, and the *Patella* has not been lengthened; the limb has been as ſtrong as before the accident took place, and the different motions of the knee-joint equally extenſive.

It appears from what has been ſaid on the anatomy and phyſiology of the knee-joint, in the ſound and diſeaſed ſtate, ariſing from the elongation of the *Patella*, that this joint is weak, looſe, and unſtable after the cure in the old way; this ariſes from the *Patella* and ligament being looſe, owing to the elongation, and on this account alſo, the knee is liable to bend from not being kept ſo firm as it is by the action of the extenſor muſcles, keeping the *Patella* and ligament firmly and rigidly fixed in the ſound ſtate of theſe parts; owing to the joint being looſe, the knee is rendered liable to bend, and the ſubject to fall and fracture the *Patella* again, or the *Patella* on the oppoſite ſide.

This laxity and inſtability in the knee-joint, ariſing from the old mode of treatment, and the diſpoſition to refracture the *Patella*, is altogether prevented by the method deſcribed in this eſſay, and if the ſurgeon will reflect, he will find a great analogy between this mode of treatment and the bending of the knee-joint in a lacerated *Tendo Achillis*. The common and old practice in the lacerated *Tendo Achillis*, which ariſes ſomewhat in a ſimilar way to the fracture of the *Patella*, is to extend the *Tarſus*, by which the inferior portion of the tendon is carried upward towards the ſuperior portion; but the knee ſhould, and is kept bent in this caſe by judicious and diſcerning ſurgeons, by which means the extenſor maſs is brought downwards, and this depends upon the *Muſculus Gaſtrocnemius* taking its origin from the thigh bone.

In a caſe of laceration of the ligament of the *Patella*, or laceration of the common tendon of the extenſor maſs of the leg, the ſame poſition of limb is to be maintained as in the treatment of the fractured *Patella*, in the new way, and the limb muſt be kept fixed in this ſituation until, and for ſome time after, the union takes place; by which means an elongation of the ligament or tendon will be prevented, as well as the conſequent defects and deformity that will otherwiſe ariſe in caſes of this kind. If patients who have ſuffered lacerations of the *Patella*, or the extenſor tendon, are not treated upon the principles here laid down, they will be lamed and rendered liable to relacerate the ligament or tendon; and I know an inſtance of an eminent ſurgeon in London, who met with this accident by endeavouring to ſtep into a coach. In this gentleman the extenſor tendon was lacerated by a ſtrong exertion of the extenſor muſcles of the leg, on one ſide, acting powerfully upon the trunk to bend it, and to carry the body into the coach. In this caſe the trunk and lower extremity was laid in the ſame right line during the cure; the tendon, of courſe, was elongated; the joint rendered weak, looſe, and unſtable from the elongation; and I ſuſpect that the extenſor muſcles dwindle and degenerate in theſe caſes after the accident, and loſe conſiderably of their muſcular energy. This gentleman has ſince relacerated the tendon.

Some have ſuppoſed that a ſtiff joint may ariſe in caſes of fractured *Patellæ*, from the *Callus* ſhooting into the cavity of the knee-joint; but the diſſections which have been made after death, ſhew us that nothing of this kind takes place, and that the elongation of the *Patella*, in theſe badly managed caſes, is formed of ligamentous ſubſtance.

I am ſorry to diſagree with Mr. Pott in two points, reſpecting the fractured *Patella*[*]. I am certain, from experience, that thoſe will walk beſt in whom the fractured portions of *Patella* are brought into accurate contact; and longitudinal fractures ſucceed better than tranſverſe, for this reaſon, ſince the fractured portions of bone are kept in accurate contact by their natural connections, in ſuch longitudinal fractures. Mr. Pott ſays, " Thoſe walk beſt in whom the broken pieces are not brought into exact contact, but laid at ſome ſmall diſtance from each other." But I would aſk Mr. Pott, whether he ever ſaw a ſimple tranſverſe, or even a longitudinal fracture of the *Patella*, where the portions of fractured bone were brought and kept in accurate contact during the cure, where any inconvenience was the conſequence. I declare I never ſaw a cure treated in the old way, without producing an elongated *Patella*. If ſurgeons think to make the *Patella* of a better form than Nature made it, they are much miſtaken.

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[*] See Chirurgical Works, by Percival Pott, F. R. S. &c. in quarto, p. 996 and 997. Printed in London, 1775.

During the latter part of the cure the joint may be cautiouſly moved, to prevent any ſtiffneſs ariſing from want of motion, or from a ſuppoſed thickening of the ligaments; taking care, by embracing the *Patella* with the hand, to prevent any diſplacement of the fractured portions of bone. The ſimple longitudinal fracture of the *Patella* requires no bandage upon the fractured part, as the natural connection will keep the divided portions in accurate contact; and in this caſe, we may and ſhould relax the extenſor muſcles a little during the cure, as the inflammation will be more liable to ſubſide from the capſular ligament of the knee-joint being relaxed.

I muſt likewiſe object to Mr. Bell. He ſays, in his Syſtem of Surgery *, "It is a fortunate circumſtance, however, that it is not abſolutely neceſſary to a complete cure, that the different pieces of bone be kept in exact contact. Where it can be eaſily done, it ought always to be put in practice; but I know from the reſult of ſeveral caſes where this was impracticable, that a cure may be obtained, and the joint be equally firm and uſeful as it was before, even although the ſeparated portions of bone cannot be brought within an inch of each other. We ſhould not therefore be very anxious about this,

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* See a Syſtem of Surgery, in octavo, vol. vi, by Mr. Benjamin Bell, p. 116. Printed at Edinburgh, 1788.

and inſtead of uſing much force for the purpoſe of drawing the bones into cloſe contact, no more ſhould be employed than the patient can bear with perfect eaſe.

Whoever follows Mr. Bell, (and does not bring the fractured portions of the *Patella* into accurate contact, which may always be effected by bending the hip-joint, and bringing down the extenſor muſcles, and ſuperior fractured portion, without giving that pain, which Mr. Bell ſays is produced by attempting to bring the fractured portions into accurate contact) will undoubtedly lame his patient; but Mr. Bell, like all thoſe who have gone before him, uſes the extended poſition; and I aver, contrary to Mr. Bell's opinion, that whenever the portions of *Patella* are not brought into contact, the defect is in proportion to the ſeparation of the fractured parts; while, on the contrary, if the fractured portions are brought and kept in accurate contact, during the cure, the patient will walk as well as before the accident, without any inconvenience in the motion of the knee-joint, and without that prediſpoſition to refracture the *Patella*, which ariſes from the mal-treatment of this caſe in the old way, or the riſk of fracturing the oppoſite *Patella*, and of refracturing both, and of receiving poſſibly, in the falls occaſioned by theſe fractures, greater and more fatal miſchief.

Thoſe who have the misfortune of having the diſeaſed looſe knee-joint, from the miſmanaged fractured *Patella*, will be aſſiſted by wearing a laced knee-cap, which will give a degree of firmneſs to the joint.

I ſhall next conſider the fracture of the *Olecranon*, an accident very analogous to the fracture of the *Patella*.

On the FRACTURE *of the* OLECRANON.

AS the fracture of the *Olecranon* is frequently badly treated, and as this part is analogous, in its ſituation and uſe, to the *Patella*, I have thought proper to add ſome obſervations, ſeeing very little has been written on this ſubject; and from having fractured this part in my own body, I have been led to a very particular conſideration of this malady.

The *Olecranon* is a proceſs ariſing from the ſuperior extremity of the bone *Ulna*. Into the upper part of this proceſs, the tendon belonging to the extenſor muſcles of the arm is inſerted in a ſimilar way to the inſertion of the extenſor muſcles of the *Patella*; the internal ſurface of the *Olecranon*, forms a part of the articular ſigmoid cavity, which enters into the compoſition of the elbow-joint; for which reaſon fractures of this proceſs almoſt always reach into the cavity of the joint: it is therefore certain that any deformity of the articular ſurface of the *Olecranon* will impede the free motion of this joint, and, in ſome caſes, a ſtiff arm, almoſt equal to a complete *Anchyloſis*, is the conſequence of ill-treatment in theſe caſes.

Like the *Patella*, the *Proceſſus Olecranon* riſes in the extenſion, and is depreſſed in the flexion of the fore-arm; when the proceſs is fractured, the extenſor muſcles are ſeparated from the body of the *Ulna*, but are ſtill connected with the ſuperior fractured portion of the proceſs. It is ſuppoſed by the major part of ſurgeons, that a ſtiff arm, or *Anchyloſis*, is the conſequence of even ſimple fractures of this proceſs, and this will ariſe in ſuch caſes where the fore-arm is kept bent during the cure: but this will not ariſe in ſimple fractures of the *Olecranon*, if the method I ſhall deſcribe is followed.

I know of no inſtance of fracture of this proceſs, by a ſtrong action of the extenſor muſcles, like that of the *Patella*;—it is moſt commonly fractured by falls or blows.

It is eaſy, in recent caſes, to diſtinguiſh a fracture in this proceſs, by the uſual application of the hands; and, if much ſwelling and tenſion has taken place, the *Crepitus* of the broken parts will eaſily be detected, upon gently moving the joint. Surgeons are ſo accuſtomed to bend the elbow-joint, in injuries of the fore arm, that they bend it in general in fractures of the *Olecranon*. If the bent poſition is maintained, a ſtiff arm is the inevitable conſequence, for the following reaſons. The upper fractured portion of the *Proceſſus Olecranon* being ſeparated from the inferior portion, and being ſtill connected by the extenſor tendon with the *muſculus triceps extenſor cubiti*, the bending of the fore-arm removes the lower portion of the *Olecranon* from the ſuperior portion ; a ſpace is left between the two fractured portions of bone ; *Callus* is afterwards formed, filling up the ſpace between the two fractured portions, and uniting them ; by this means, the *Olecranon* is unnaturally lengthened, the articular ſurface has got an imperfect form, and its concavity does not correſpond with the convex articular ſurface of the *Trochlea* of the *Os Brachii*, upon which it revolves in the flexion and extenſion of the fore-arm ; and it is even poſſible that the free motion of the *Radius* may be affected by a redundant *Callus*, in ſuch maltreated caſes. In order that my readers may underſtand rightly this fracture, and my obſervations upon it, I ſhall conſider next the anatomy of the parts concerned in this fracture.

The joint of the elbow is compoſed by three bones, the *Os Brachii*, the *Ulna*, and the *Radius*, and is a ſimple hinge-like joint;—the *Trochlea* or pulley of the lower extremity of the *Os Brachii*—the ſigmoid cavity of the *Ulna*, which is ſituated on the internal ſurface of the *Olecranon*—and the glenoid cavity lying upon the head of the *Radius*, form the three articular ſurfaces compoſing this joint. Between the two condyles of the *Os Brachii*, immediately above the *Trochlea*, we may obſerve a cavity behind, which receives the *Pro-*

ceſſus Olecranon, and locks it in the extended poſition of the arm, making the arm and fore-arm in this ſtate, nearly as firm, rigid, and inflexible, as if the whole conſiſted of one bone. There is a ſmaller cavity between the two condyles on the anterior ſurface of this bone, which receives and locks the coronoid proceſs of the *Ulna*, and keeps the fore-arm firmly fixed, in the greateſt ſtate of flexion. The motions of this joint are flexion and extenſion. The flexion is effected by two muſcles, which are ſituated principally on the anterior ſurface of the *Os Brachii*; the one is named *Biceps flexor cubiti*, the other *Brachiæus internus*: the *Biceps* is inſerted in the tuberoſity of the *Radius*, and throws off an *Aponeuroſis* which is expanded on the muſcles lying on the anterior part of the bones of the fore-arm; the *Brachiæus internus* is inſerted in the anterior ſurface of the *Ulna*, juſt below the coronoid proceſs. The extenſor maſs lies principally on the back part of the *Os Brachii*, and is called the *Triceps extenſor Cubiti*: there is likewiſe a ſmall extenſor muſcle named *Anconæus*, which is, in my opinion, a continuation of the *Triceps*. The *Triceps* ariſes by three heads; the long head ariſes from the lower edge of the *Cervix Scapulæ*, the ſecond and third heads, forming the *Brachiæus externus* of Douglas, ariſe from the back part and outſide of the *Os Brachii.* The *Triceps* is inſerted by a ſtrong and flat tendon in the upper part of the *Proceſſus Olecranon*: the muſcle called *Anconæus* is a continuation of the lower muſcular portion of the *Triceps*, which is inſerted in the *Ulna*, a little below the *Proceſſus Olecranon*; this muſcular maſs produces the extenſion of the fore-arm. Whoever conſiders the anatomy and phyſiology of the parts concerned in this fracture, will find that the bent poſition of the fore-arm, not only tends to ſeparate the fractured portions of the broken *Olecranon*, but leaves a ſpace between the *Os Brachii* and *Ulna*, and forms a cavity in the joint, into which the *Callus* is at liberty to ſhoot. The conſequences ariſing after

ter the cure are a mal-conformation in the *Proceſſus Olecranon*, owing to it's being lengthened, and, as before obſerved, getting into the cavity of the joint; although the lengthening of the proceſs is ſufficient to lame the patient for life; this will depend on the upper large portion of the *Olecranon*, inſtead of falling into the natural cavity made to receive it, in the extended poſition of the fore-arm, preſſing above the cavity of the *Os Brachii*, and, of courſe, a lame, ſtiff arm is the conſequence of the ſurgeon's having maintained the bent poſition of the fore-arm.

If any doubt ſhould ariſe of the

lameneſs not proceeding from the elongation in mal-treated caſes, from the bent poſition being uſed, let the *Ulna* of the ſound arm be meaſured from the point of it's ſtyliform proceſs to the upper part of the *Olecranon* in both arms; when it will be found that the *Ulna* is longer in the broken than in the ſound fore-arm. This can be eaſily effected, with great accuracy, as the *Olecranon*, and the ſtyliform proceſs can be diſtinctly felt in the living body.

I am of opinion that ſomething might be done to relieve thoſe who have had the misfortune to be lamed in caſes of the fractured *Olecranon*,

cranon, and I ſhould not heſitate, in a recent caſe of this kind, finding the lameneſs to depend merely upon the elongation by *Callus*, as the *Olecranon* is not covered by any muſcle or large veſſels of any kind, to take out the elongated portion produced by the *Callus*; I ſhould hope, however, that no man would attempt this operation, but an expert practical anatomiſt; and I wiſh my readers not to apply an operation of this kind to any other caſe than the elongated fractured *Olecranon*. The method of performing this operation I will deſcribe after I have conſidered the proper methods of treating the fractured *Olecranon*. In a recent caſe of fractured *Olecranon*, it is the duty of the ſurgeon to bring the fractured portions into accurate contact, to prevent and diminiſh as much as poſſible inflammation, in order to prevent ſuppuration taking place in the joint, and to leave the muſcles connected with the proceſs, in a ſtate of relaxation. This he will effect by extending the arm. In ſo doing, he will bring up the lower fractured portion of *Olecranon*, which will now get into contact with the ſuperior fractured portion; he will relax the extenſor muſcles, which will be put upon the ſtretch in the bent poſition, owing to the connection which the *Muſculus Anconæus* has with the *Ulna*, below the fractured *Olecranon*, and the *Muſculus Triceps* above the joint; he will, by extending the fore-arm, lock the ſuperior fractured portion of *Olecranon* in it's natural cavity, formed by the poſterior ſemilunar cavity of the *Os Brachii*. The cavity of the joint no longer exiſts when the fore-arm is extended, ſince the *Ulna* and *Trochlea* are now in accurate contact in all points of their articular ſurfaces, and the *Callus* cannot ſhoot into the cavity of the joint; therefore, every kind of miſchief capable of ariſing from the *Callus* filling the cavity of the joint, is prevented, and a redundancy of *Callus* is avoided, by the fractured parts being in accurate contact, and, of courſe, the *Ulna* has it's old original length and form, in all parts; ſo that a ſimple fracture the *Olecranon*, after the cure, cannot be diſtinguiſhed by the beſt ſurgeon, in caſes of this kind, that are well treated. The acute pain and great inflammation that will attend the majority of caſes, when the fore-arm is bent, by keeping the extenſor muſcles and capſular ligament upon the ſtretch, and ſeparating the fractured portions of the *Olecranon*, will be diminiſhed, and ſoon removed, by maintaining the extended poſition; the poſterior ſemilunar cavity, which is ſituated between the two condyles of the *Os Brachii*, will fix the ſeparated portion of the fractured *Olecranon* ſo ſteadily as to prevent any elongation or redundant *Callus*. No ſplints or other inventions of the chirurgic art, can poſſibly retain it in ſuch accurate appoſition as the proper cavity, formed by Nature to receive it. It is a long time, in general, before the fractured portions are united by *Callus*; I would therefore adviſe the ſurgeon to embrace the fractured part with his fingers, and move the fore-arm, by bending and extending it during the latter part of the cure, to prevent any ſtiffening or improper adheſion of the capſular ligament, which, we may ſuppoſe, is ſometimes lacerated in fractures of the *Olecranon*. It may not be improper to move the *Radius* alſo, by the pronation and ſupination of the hand, placing the fractured parts, after making ſuch motions, in the extended ſtate, as before directed, and ſecuring the parts in that poſition by bandages and ſplints.

In a former part of this eſſay, I hinted that ſomething might be done to relieve thoſe who have fractured the *Olecranon*, and in whom it is elongated, from the bent poſition having been made uſe of. In a recent caſe of this kind, where a ſtiff arm was the conſequence, I propoſed to remove the elongated new formed portion, and to reduce the *Ulna* to its original length and form. The propriety of performing ſuch an operation, reſts upon the following conſiderations: that the bone at this part is covered only by ſkin—that the cavity of the joint is ſmall—that the *Ulna* in the oppoſite arm may be meaſured from the ſtyliform proceſs to the upper part of the *Olecranon*, and, being compared with the diſeaſed *Ulna*, the quantity of the elongation may be diſcovered; added to this, I have ſeen two inches and a half of the *Ulna*, with the *Proceſſus Olecranon*, removed in a caſe of venereal caries, by the late Mr. Juſtamond, in the Weſtminſter Hoſpital, with ſuch ſucceſs, as to leave a tolerable good joint, with very conſiderable motion. This operation might be eaſily affected by making a ſemilunar inciſion in the ſkin, in the longitudinal direction of the *Olecranon*; which will give the ſurgeon every advantage of the crucial inciſion; he may readily diſſect the ſkin from the adjacent bone, as it may be kept out of his way by the aſſiſtants: he is then to remove the new formed portion by a very fine ſaw; having removed it, he is next to place the arm in an extended poſition, by which means he will carry the ſuperior now ſeparated portion of the *Olecranon*, which adheres to the tendon of the extenſor maſs into the poſterior ſemilunar cavity of the *Os Brachii.* The lips of the wound in the ſkin are next to be brought into accurate contact by pieces of adheſive plaiſter and proper bandage, and ſplints applied to maintain the extended poſition of the fore-arm. I ſhould entertain little doubt of ſucceſs attending this operation, if well executed, as it might be by an expert practical anatomiſt. If well done, it would not be attended with a great deal of pain, as the ſkin might be quickly divided, and bone is hardly ſenſible in a ſound ſtate; motion ſhould be uſed, as before directed, during the latter part of the cure.

In old caſes of ſtiff arms from this cauſe, this operation ſhould not be performed, as the muſcles will mould themſelves to the bent ſtiff arm, and the form of the bones in and about the joint alter: this I have found to be the caſe, from the diſſection of ſuch joints after death.

FINIS.